Centricity Cardiology INW Operator’s Manual

Operator's Manual

Version 6.5

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GE Medical Systems
Information Technologies

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The information in this manual only applies to Centricity Cardiology INW software version 6.5. It does not apply to earlier software versions. Due to continuing product innovation, specifications in this manual are subject to change without notice.

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CE Marking Information

Compliance

NOTE

This CE mark information is part of the operator manual and is applicable for all products marketed and delivered by GE Medical Systems Information Technologies in the European community.

The Centricity Cardiology INW system bears CE mark 0459 indicating its conformity with the provisions of the Council Directive 93/42/EEC, concerning medical devices and fulfills the essential requirements of Annex I of this directive.

The country of manufacture and appropriate Notified Body can be found on the equipment labeling.

Refer to the Mac-Lab/CardioLab Service Manual for EMC Immunity Performance exceptions.

Recommendations

Users should be aware of known RF sources, such as radio or TV stations and hand-held or mobile two-way radios, and consider them when installing a system.

Be aware that adding accessories or components, or modifying the system may degrade the EMI performance. Consult with qualified personnel regarding changes to the system configuration.

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1 Introduction

Document Information

Revision History

Revision History, PN 20221423-017		
Revision	Date	Comment
A	15 July 2005	Initial release of the document.
B	01 October 2005	Updated for SPR MMSmk92111
C	6 June 2007	Updated for SPR GEHmk06120, GEHmk06133, GEHmk07607, GEHmk08106, GEHmk08285, GEHmk10366, and by field review.

Purpose

This manual contains instructions necessary to operate the Centricity Cardiology INW server safely and in accordance with its function and intended use. Read this manual completely and use it as a reference guide to gain a working knowledge of the system.

Related Documents

Refer to the documents listed below for additional information.

2021423-015: Mac-Lab Operator's Manual

2021423-016: CardioLab Operator's Manual

2021423-018: Mac-Lab/CardioLab Security Guide

2021423-021: Mac-Lab/CardioLab Pre-Installation Manual

2021423-022: Mac-Lab/CardioLab Service Manual

Safety Messages

DANGER
DEATH OR SERIOUS INJURY — Safety messages which indicate an imminently hazardous situation which, if not avoided, WILL result in death or serious injury.

WARNING
POSSIBLE DEATH OR SERIOUS INJURY — Safety messages which indicate a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.

CAUTION
MINOR INJURY OR LOSS OF DATA — Safety messages which indicate a potentially hazardous situation which, if not avoided may result in minor or moderate injury or loss of data.

NOTE
Messages which provide additional user information.

Illustrations and Names

All illustrations in this manual are provided as examples only. They may not necessarily reflect your setup of data displayed on your monitor.

In this manual, all names appearing in examples and illustrations are fictitious. The use of any real person's name is purely coincidental.

Safety Information

Responsibility of the Manufacturer

GE Medical Systems Information Technologies is responsible for the effects of safety, reliability, and performance only if:

- Assembly operations, extensions, readjustments, modifications, or repairs are carried out by persons authorized by GE Medical Systems Information Technologies
- The electrical installation of the relevant room complies with the requirements of the appropriate regulations.
- The equipment is used in accordance with the instructions for use.

Responsibility of the User

- Customers are responsible to stay informed with vulnerability notification from Microsoft and to visit the GE Healthcare Product Security website to understand the impact on Mac-Lab, CardioLab, ComboLab, and INW systems.
- Customers are responsible for the installation of any needed Microsoft software patches. The listing and link of the Microsoft software patch will be available by the product name on the website.

Equipment Safety

The safety statements presented in this chapter refer to the equipment in general and, in most cases, apply to all aspects of the product.

The order in which safety statements are presented in no way implies order of importance.

Dangers, Warnings, and Cautions

Additional safety messages may be found throughout this manual that provide safe operation information.

DANGER
EXPLOSION HAZARD —

Do not use in the presence of flammable anesthetics or other flammable gases.

WARNING
ACCESSORIES —

Only connect UL 544 or UL 2601-1 listed or IEC certified medical equipment.

WARNING
ACCIDENTAL SPILLS — If fluid of any kind should leak into the system, discontinue use of the equipment and contact GE Medical Systems Information Technologies immediately.

DO NOT allow hydraulic fluid from any device to contact any conductive surface. Hydraulic fluid is electrically conductive.

WARNING
IEC —

All equipment not complying with IEC 601-1 should be placed outside the patient environment.

WARNING
LEAKAGE CURRENT TEST — When more than two electrical devices are interconnected, the summation of leakage currents must be checked yearly. The system should be tested yearly for adequate grounding on patient leakage current.

Keep leakage current within acceptable limits when connecting auxiliary equipment to the system.

WARNING
MAINTENANCE/SERVICE — High voltages exist in the unit.

Use insulated tools. Remove jewelry and use only one hand when possible.Always disconnect the power from the equipment before attempting service.

WARNING
PINCH POINT HAZARD —

Keep hands, hair, jewelry and loose clothing away from moving parts. Otherwise, serious injury could result.

WARNING
PACEMAKERS — Minute ventilation rate-adaptive implantable pacemakers can occasionally interact with certain cardiac monitoring and diagnostic equipment, causing the pacemakers to pace at their maximum programmedrate.Total chassis leakage current must not exceed 100 microamperes.

Voltages between the three power outlet connections must be accurate BEFORE measuring power outlet ground-to-neutral loop resistance.

WARNING
POWER SUPPLY – — Electrostatic discharge (ESD) can damage electronic components.This equipment is designed for connection to a earth grounded power outlet. High voltage is present on this assembly.

Be sure you are properly grounded when using or servicing the system.Connect the system to a power outlet equipped with emergencypower.To reduce the risk of electric shock or damage to the equipment, do not disable the power cord grounding feature. The supply line must be fused and capable of delivering 20A.Route the AC power cable away from moving parts.Avoid electrical shock by unplugging the unit from the power source before touching.Connect only to a properly earth grounded outlet.

WARNING
REPLACEMENT —

Replace only with the same type and rating of fuse.

WARNING
SHOCK HAZARD — An electrical shock hazard exists between chassis ground and isolated (floating) ground when power is applied. This equipment is designed for connection to a earth grounded power outlet.

Unplug the unit from the power source before proceeding.To reduce the risk of electric shock or damage to your equipment, do not disable the power cord grounding feature. The grounding plug is an important safety feature.

WARNING
SUPERVISED USE —

This device is intended for use under the direct supervision of a licensed health care practitioner.

CAUTION
RESTRICTED SALE —

Federal USA law restricts this device to sale by or on the order of a physician.

CAUTION
EMC — No known electromagnetic or other interference between the system exists.

However, precautions should be taken to avoid the use of cellular telephones, pagers, or other transmitters.

CAUTION
SOFTWARE —

DO NOT add unauthorized software or patches to the INW server system. Doing so may make the INW software unstable. Exit the software application properly before turning off the system to ensure data integrity. Unpredictable system operation and void of warranty and service contract may occur.

CAUTION
INCORRECT DATA — Changing the system time during a study may cause the event log not to reflect the events as they actually happened. An apparent lag time may be introduced, or events may appear out of order.

Do not change the system time during a study.

Operating Environment

CAUTION
SOFTWARE VIRUS INFECTION OR UNAUTHORIZED ACCESS — Creating open shares on the server may compromise security.

Do not create open shares on the server without authorization from the facility system administrator.

Centricity INW Cardiology Server:

- Windows 2003 Standard
- Microsoft SQL Server 2000 Standard

2 Data Management Procedures

Introduction

Description

The INW server provides sites with the ability to review patient data during and after data acquisition, and allows for a centralized point of data access. The INW server, the CardioLab and Mac-Lab acquisition systems, and the various review stations communicate between themselves and other equipment on the network over an ethernet network utilizing TCP/IP.

Central list management (for staff, supplies, and so forth) automatically runs on the INW Server by utilizing a mapped network drive/ UNC path to the CVIS system.

Basic Terms

These terms describe basic operations on the server:

- **Push Studies**: Describes the process of copying the files from the Acquisition System to the INW server. Other workstations will then have access to the data once it is stored on the INW server. Pushing studies runs as a scheduled job, with no action required by the operator. The *Archive Generator* job that performs this function is set up upon installation for each acquisition system.
- **Replication**: Describes the process of synchronizing system lists (i.e., Procedures, Staff, Medications, Macros) from the INW server to the Acquisition systems. The INW server receives a copy of the master list via the Central List management. The INW server then replicates the lists to the Acquisition systems.
- **Backup**: Describes the copying of the data from the INW onto tape (or other media) so that patient and system data may be restored in the event of failure of the INW server. Backup is performed by the operator on a regular schedule. There are two types of backups:
  - Full Backup: All the system information is copied onto tape.
  - Incremental Backup: Only the data that has been changed since the last backup is copied onto tape. An Incremental Backup usually takes much less time than a Full Backup.

  A typical backup schedule will include both Full Backups and Incremental Backups.
- **Archiving**: Describes the copying of patient data over a network from the server to a long-term storage location, and the subsequent removal of that data from the server. This operation is done to free

up storage space on the server. Archiving is optional and is performed by the operator. The *Archive Utility* assists the operator with this function.

Customer Responsibilities

- The customer must maintain and back up archive storage locations on a regular schedule.
- The customer must keep accurate records of archived study locations so that studies can be easily located if needed.
- The Customer is responsible for scheduling and maintaining all server backups (i.e., GE Medical Systems Information Technologies is not responsible for data loss due to customer negligence).
- The customer must keep accurate backup logs in order to retrieve the appropriate backup when needed.
- If tapes will be used to backup data please be advised that tape backup requires human intervention. For incremental backups and for full backups that use a single tape the user has to insert the appropriate tapes on daily basis for the backups to run successfully. For full backups that use multiple tapes, apart from inserting the appropriate tapes, the user also has to manually prepare the additional tapes used by the full backup on a weekly basis. Not inserting the appropriate tape for backups or not preparing the additional tapes for multiple tape backups prior to the backup will cause the tape backup to fail.
- The customer is fully responsible for all data when using non GE software (i.e., GE Medical Systems *Information Technologies* is not responsible for data loss during Enterprise Backup).
- GE Medical Systems *Information Technologies* is not responsible for data loss if these conditions are not met.

Logon

The data management procedures listed below require administrative privileges.

Contact the facility IT department for the current logon if necessary.

Recommended Schedule

GE Medical Systems *Information Technologies* recommends the following schedule for a facility with a server and four acquisition computers, based on a 5-day, single-shift work week.

NOTE

The following schedules are staggered because the Archive Generator must NOT be scheduled to start within 5 minutes of the hour or half-hour. Also, more than one Archive Generator must not run at the same time.

- Daily (Monday Night-Tuesday Morning through Thursday Night-Friday Morning):

  11:05 pm: Archive Generator on AC1 (the archive generator schedule was set when the acquisition computer was installed or upgraded).

  11:35 pm: Archive Generator on AC2

  12:05 am: Archive Generator on AC3

  12:35 am: Archive Generator on AC4

  1:05 am: Run the *Backup clab, clink databases and GEMS registry* job.

  2:05: Incremental Backup on the Server.
- Weekly (Friday Night-Saturday Morning)

  11:05 pm: Archive Generator on AC1

  11:35 pm: Archive Generator on AC2

  12:05 am: Archive Generator on AC3

  12:35 am: Archive Generator on AC4

  1:05 am: Run the *Database Maintenance* job.

  2:05 am: Run the *Backup clab, clink databases and GEMS registry* job.

  3:05: Full Backup on the Server. 50 GB of data takes approximately 2 hours.
- Monthly (Last Sunday of the Month)

  3:10 pm: Run the *Backup Master and MSDB databases* job. This job may be run concurrently with other jobs.

Database Maintenance and Backup

Introduction

The database maintenance and backup utilities performs the following:

- Consistency and Integrity Checks on the clab database
- Re-indexing tables in the clab database
- Updating table statistics in the clab database
- Recompiling all the stored procedures in the clab database

- Running consistency checks against the master database
- Backing up the clab database and registry to:
  D:\GEMMS\PRUCKA\Database\Maintenance\backup
- Backing up the clink database (if available)
- Backing up the Master and MSDB backups.

Schedule INW Server Database Jobs

Three database jobs must be scheduled:

- *Backup clab, clink databases and GEMS registry*. Schedule this job to run nightly.
- *Database Maintenance*. Schedule this job to run weekly.
- *Backup Master and MSDB databases*. Schedule this job to run monthly.

Refer to the Recommended Schedule in the Introduction section of this chapter for specific information.

1. Open the *SQL Server Enterprise Manager* in the *Start* menu. The *SQL Server Enterprise Manager* window is displayed.
2. Go to *Microsoft SQL Servers > SQL Server Group> [Your Server Name] > Management > SQL Server Agent > Jobs* and double-click the job to be scheduled.
3. Select the *Enabled* checkbox.
4. Select the *Schedules* tab.
5. Select *New Schedule*.

   Enter the following information:

   - *Name*: Select an applicable name, such as *Daily Maintenance* for the *Backup clab, clink databases and GEMS registry* job.
   - *Enabled*: Selected
   - *Recurring*: Selected

   Click the *Change* button. The *Edit Job Schedule* window is displayed
6. Enter the scheduling information and click *OK*.

   NOTE
   Refer to the schedule in the Recommended Schedule in the Introduction section of this chapter.
7. Repeat this procedure for the other two jobs.

Verify Database Jobs Ran Successfully

The day after each job is scheduled to run, check the following log files in *D:\GEMMS\Prucka\Database\Maintenance\Log* to ensure the job ran successfully (each log will have a message that the job ran successfully at the correct time):

- Daily: *gemms_backup_clab.log*
- Weekly:*db_maint_*.log* (there will be 5 files).
- Monthly: *gemms_backup_msdbdb_*.log* and *gemms_backup_msdbdb_*.log*

Tape Backup

Introduction

Files backed up include:

- clabbackup.bak: The Mac-Lab/CardioLab database (backed up version created daily by the Backup clab, clink databases and GEMS registry job).
- Gems.reg: GEMS registry containing application configuration settings (e.g., archive schedules)
- Patient Folders: Includes reports and raw waveform files referenced in the clab database, images, and snapshots.

Seven tapes are initially needed for the recommended backup schedule:

- Two full backup tapes are required so one full backup is always available (in case the current full backup fails). Each full backup is run on an alternate Saturday. For example, if Full Backup 1 runs on Saturday, May 1, then Full Backup 2 will run on Saturday, May 8, and Full Backup 1 will run again on Saturday, May 15, etc.
- Four incremental backup tapes are required from Tuesday through Friday. Incremental backups are run early in the morning to capture the changes from the previous day.
- One tape is required for the On Demand Backup.
- As data on the server increases, additional tapes will be needed by the Full Backups and the On Demand Backup.

Create Backup Tapes and Schedule Backups

These instructions show how to configure a full tape backup using single or multiple tapes as well as the incremental tape backups.

CAUTION
PROCEDURE FAILURE — Please be advised that tape backup requires human intervention.

- For full backups that use single tape and incremental backups the user has to insert appropriate tapes on daily basis for backups to run successfully.
- For full backups that use multiple tapes apart from inserting the appropriate tapes the user has to manually prepare the additional tapes. Refer to section "Free additional tape" for details on how to prepare additional tapes.

1. Delete Previously Scheduled Backup Jobs on the Server

If a previous backup schedule is already in place on the server, it must be deleted:

1. Go to *Start* > *Settings* > *Control Panel* > *Scheduled Tasks*
2. Delete any previously scheduled tape backup jobs.

2. Determine Number of Tapes Needed for Full Backup

1. Login on to the server as **Administrator**
2. Right click on *My Computer* and select *Explore*.
3. Browse to
   a. *D:\GEMMS\Prucka\Studies*
   b. *D:\GEMMS\Prucka\Database\Maintenace\Backup*
   c. *D:\GEMMS\Prucka\Database\Maintenace\Log*

   For each of these folders right-click on the folder and choose *Properties* to view the size of the folder.

4. If the total size of the *Studies*, *Backup* and *Log* folders from the above step is greater than the tape size, then multiple tapes will be needed for full backups.

3. Physically Label the Backup Tapes

Place a sticker on each tape with the labels listed below, then perform the procedures below for each tape.

- Tuesday Incremental. Backups normally run in the early morning, so the tape is actually put in the drive at the end of the previous day (in this case, Monday evening.)
- Wednesday Incremental
- Thursday Incremental
- Friday Incremental
- Full Backup 1 (Full Backup 1 - 2, Full Backup 1 - 3, etc. for additional tapes in case of multiple tape backups)
- Full Backup 2 (Full Backup 2 - 2, Full Backup 2 - 3, etc. for additional tapes in case of multiple tape backups)
- On Demand Backup(On Demand Backup - 2, On Demand Backup - 3, etc. for additional tapes in case of multiple tape backups)

NOTE

When labeling the tapes, it is important to use a consistent naming convention. If consistent names are not used, the procedures below will fail.

4. Catalog Backup Tapes

This procedure runs a dummy backup to label (name) the tape and create an initial catalog. This backup will be overwritten when the actual backup is run.

NOTE

The tapes are automatically formatted during this procedure.

Delete Catalog

1. Open the *Backup Utility* by selecting *Start > Programs > Accessories > System Tools > Backup*.
2. If the Backup application opens in Wizard mode, click *Advanced Mode*.
3. Click the *Restore and Manage Media* tab.

4. Click *8mm AIT1*. If any tapes are listed in the right pane, right-click each *Backup Identification Label* and select *Delete Catalog*. When the message *Are you sure you want to delete this media?* is displayed, select *Yes*. Ensure all tapes are deleted.

Catalog Tapes

1. Insert the first tape (for example the one labeled Full Backup 1) into the tape drive. Wait for a message to be displayed.
2. If the message *Unrecognized Media Found* is displayed, accept any confirmation messages and check the *Restore and Manage Media* tab and confirm the tape is listed under Free Media. Skip the next step.
3. If the message *Recognizable Media Found* is displayed:
   a. Select *Allow Backup Utility to Use this Media*
   b. Click *OK*. The media is displayed under 8mm AIT1.
   c. Right-click the media and select *Mark as Free* and click *Yes* to confirm.
4. Go to the *Backup Utility Welcome* tab.
5. Click on *Backup Wizard*.
6. Click *Next*.
7. Select *Backup selected files, drives, or network data* and click *Next*.
8. In the *Items to Back Up* window expand the *My Computer* icon and select a sample folder to backup (this is done just to assign a name to the tape. The actual backup is performed below. Use the *D:/Gemms/Prucka/Database/Maintenance/Log* folder for example). Click *Next*.
9. Select *8mm AIT1* for the backup type and *New* for the tape to use. Then click *Next*.
10. Click *Advanced*.
11. Click *Next* for the next three screens (accept the defaults).

CAUTION

BACKUP FAILURE — All label names must be written exactly the same or the backup will fail.

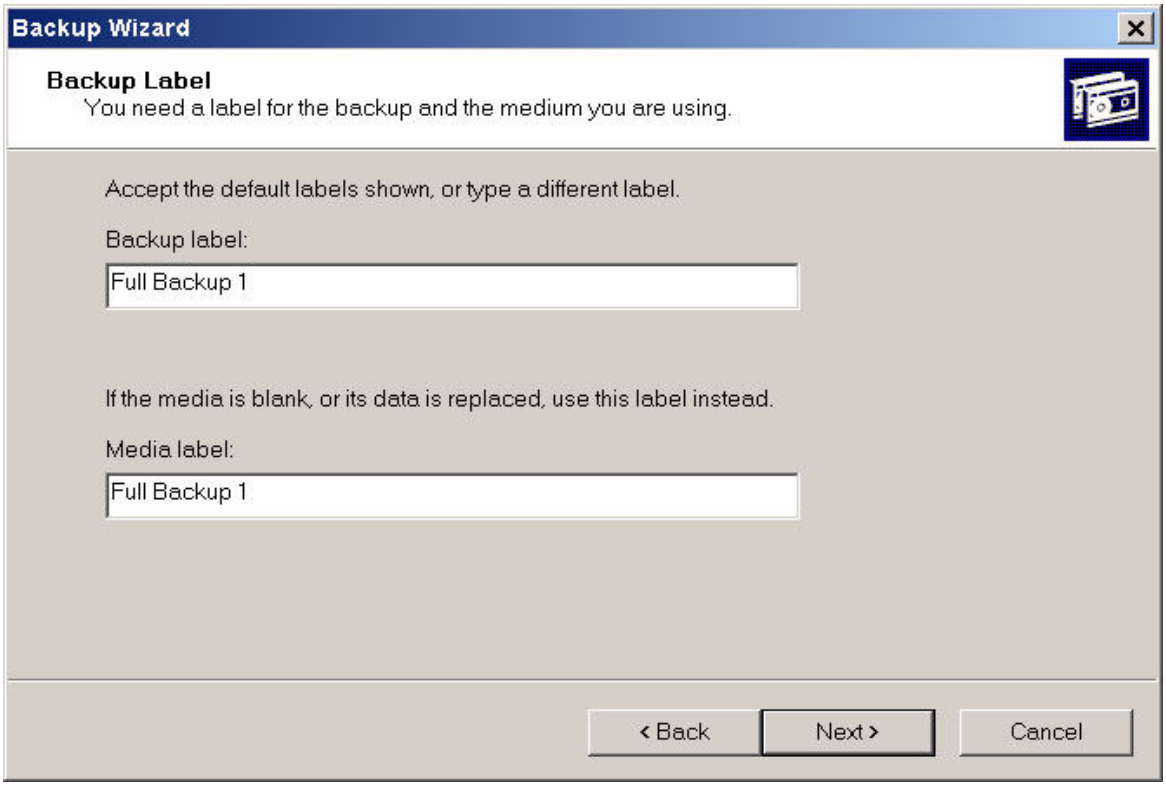
Ensure the name written on the outside of the tape, the backup label, the media label, and the job name all match exactly.

12. Change the backup label and media label to the name written on the label on the outside of the tape (In this case Full Backup 1). Click *Next*.

NOTE

For multiple tape backups, name the first tape as Full Backup 1 or Full Backup 2 or On Demand Backup as the case might be. Then for additional tapes:

- For Full Backup -1 as Full Backup 1 - 2, Full Backup 1 - 3, etc
- For Full Backup -2 as Full Backup 2 - 2, Full Backup 2 - 3, etc.
- For On Demand Backup as On Demand Backup - 2 , On Demand Backup - 3, etc.


Backup Wizard
Backup Label
You need a label for the backup and the medium you are using.
Accept the default labels shown, or type a different label.
Backup label:
Full Backup 1
If the media is blank, or its data is replaced, use this label instead.
Media label:
Full Backup 1
< Back
Next >
Cancel

004

13. Click *Finish*. When the backup is complete, click *Close*.
14. Eject the tape.
15. Repeat this procedure for each remaining tape so that all tapes labeled earlier in "3. Physically Label the Backup Tapes" are cataloged (including the additional tapes that will be used in multiple tape backups).

5. Configure storage to automatically return backup media to the free media pool

1. Right-click *My Computer* and select *Manage*.
2. Double-click *Removable Storage*.
3. Double-click *Media Pools*.
4. Double-click *Backup*.
5. Right-click the media pool *8mm AIT1* and choose *Properties*.

6. In the *General* tab check the *Return media to Free media pool* check box.
7. Press *Apply* and choose *OK*.
8. Close the *Computer Management* dialog box.

6. Schedule Backups

This procedure sets the schedule for the backups to run. When performing this procedure for each tape note the following:

- Ensure the tape labels are typed in accurately. If the tape name is different the backups won't run.
- Be sure to set the start time for Full Backup 2 to one week after Full Backup 1, otherwise both backups will try to run on the same day.
- Check all backup options carefully. When performing this procedure for each tape, the defaults may reset.

NOTE

If the full backup for this server is a single tape backup you can start with an incremental backup -- a full backup is not necessary to start the backups. All selected files and folders are backed up, so an initial full backup is not required. But if you expect to use multiple tapes for full backup then a full backup should be executed first, as incremental backups are not configured to span multiple tapes. Based on this suggested schedule the "On Demand Backup" (a full backup) is executed after scheduling the jobs, and will serve as the first full backup.

1. Go to the *Backup Utility Welcome* tab.
2. Click *Backup Wizard*.
3. Click *Next*.
4. Select *Backup selected files, drives, or network data* and click *Next*.
5. In the *Items to Back Up* window expand the *My Computer icon* and select the following folders:
   - *D:\Gemms\Prucka\Database\Maintenance\Backup*
   - *D:\Gemms\Prucka\Database\Maintenance\Log*
   - *D:\Gemms\Prucka\Studies*
6. Click *Next*.
7. Select *8mm AIT1* and select the name of the backup tape (for example, Full Backup 1) from the dropdown list. For multiple tape

full backups pick the first tape. For example for Full Backup 1 pick the tape that is labeled as Full Backup 1. Then click *Next*.

NOTE

It is very easy in this step to forget to select the tape name and leave the default 'New' in.

8. Click the *Advanced* button.
9. Select the type of backup:
   - Normal for Full Backup 1, Full Backup 2, and On Demand Backup.
   - Incremental for daily Incremental backups.

   and click *Next*.
10. Select *Verify Data after Backup* and *Use Hardware Compression* (if available) and click *Next*.
11. Select *Replace Existing Backups* and click *Next*.

CAUTION

BACKUP FAILURE — All label names must be written exactly the same or the backup will fail.

Ensure the name written on the outside of the tape, the backup label, the media label, and the job name all match exactly.

12. Change both the backup label and media label to the tape name used when labeling the tape (for example, Full Backup 1) and click *Next*.
13. Select *Later* and enter the job name (for example, Full Backup 1 or Tuesday Incremental) for the backup name. Then click *Set Schedule*.
14. Schedule the task:

    For Full Backup 1 select:

    - Weekly
    - Every 2 Weeks
    - Saturday (ensure no other days are checked)
    - Appropriate Start Time

    For Full Backup 2 select:

    - Weekly

- Every 2 Weeks
- Saturday (ensure no other days are checked)
- Appropriate Start Time
- Click the *Advanced* button and change the start day to the Friday following the first Full Backup 1. For example, if Full Backup 1 runs Saturday, May 1, then the start day for Full Backup 2 must be Friday May 7 (if the start day should be the day before the backup is scheduled to run).

For each incremental backup, select:

- Weekly
- Every 1 Week
- The appropriate day (Tuesday-Friday)
- Appropriate Start Time

For On Demand Backup select:

- Once
- Tonight
- Appropriate Start Time

15. Click *OK*.
16. Enter the **administrator** password (**MLCL8273!admin**) and click *Next* (the password will be requested again) and click *OK*.
17. Click *Finish*.
18. Repeat the above steps for the remaining tapes. DO NOT repeat for all tapes in multiple tape full backups. Create only one job for a set of full backup tapes.
19. When all jobs are created continue with the next procedure below.

7. Multiple Tape Preparation

Execute these instructions for multiple tape full backup scenarios. It prepares the additional tapes for first time use. Not preparing the tape will cause failure of the full tape backup that uses multiple tapes.

NOTE

Nothing has to be changed for the first tape that will be used for full backup and for the tapes that will be used in incremental backups.

1. Ensure all tapes of a multi-tape backup are of the same type and capacity.
2. Verify that you are logged on to the server as *Administrator*.
3. Prepare the additional tapes in the order they will be used, First prepare additional tapes for On Demand Backup (On Demand Backup - 2, On Demand Backup - 3, etc) then additional tapes for full backup 1 (Full Backup 1 - 2, Full Backup 1 - 3, etc) and then for Full Backup 2 (Full Backup 2- 2, Full Backup 2- 3, etc).

   NOTE
   It is important that the additional tapes are prepared in the order they will be used by the backup jobs otherwise the backup job will prompt for a wrong tape.

   a. Insert the tape.
   b. Right click *My Computer* and select *Manage*.
   c. Expand the *Removable Storage* under *Storage*
   d. Click on *Media*

      NOTE
      It may take up to 1 minute for the system to recognize the tape.

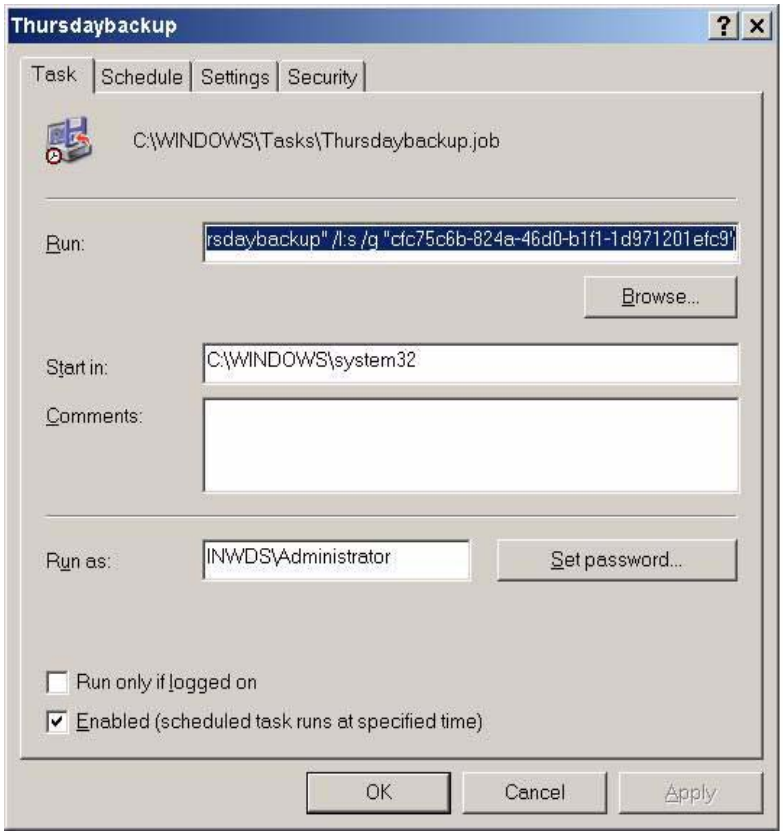
   e. Right click on the *Media* (tape) that was just inserted and select *Properties*.
   f. Ensure *Enable Media* is checked.
   g. Click *OK* and close the *Properties* dialog.
   h. Right click the tape being prepared and select *All Tasks* > *Deallocate*. Select *Yes* to the confirmation dialogs.
   i. Verify that the tape just de-allocated is listed under *Free\8mm AIT 1 Media* pool.
   j. Eject the tape.
   k. Repeat these steps for each additional tape (2nd and 3rd tape) that will be part of the full backups.

8. Add the /UP Switch

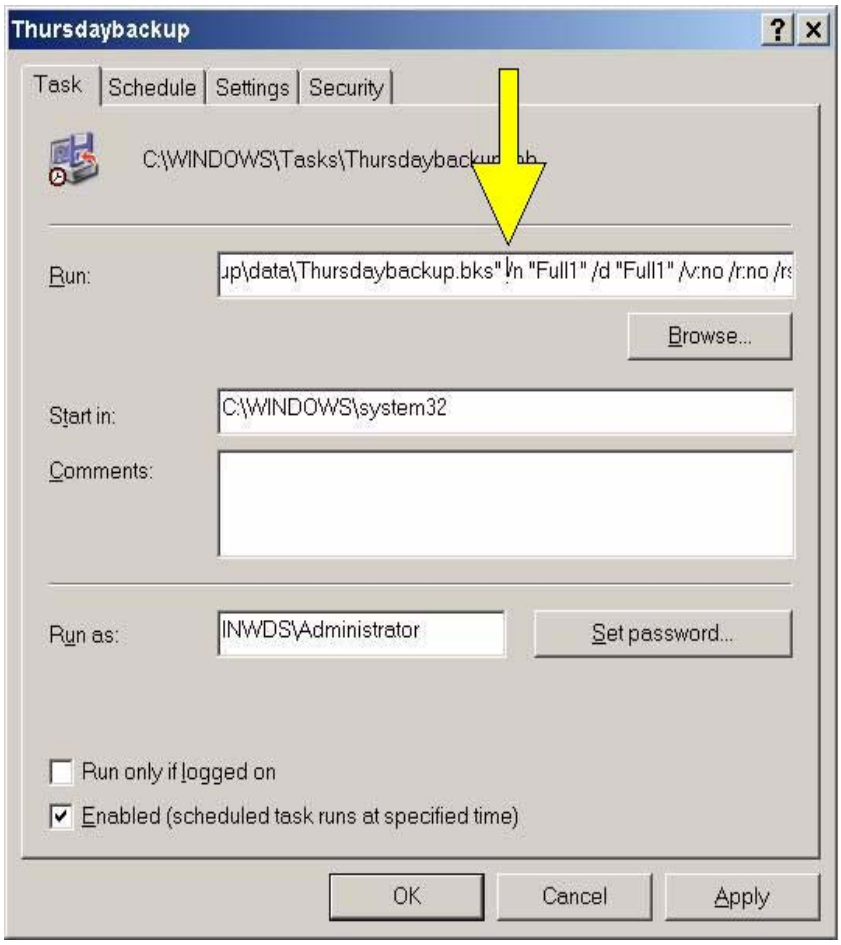
1. In the Control Panel, under *Scheduled Tasks* right click a scheduled full backup task and select *Properties* (since Incremental backups do not exceed one tape in length, those tasks will not be altered. Even if

the current full backup doesn't exceed one tape add the /UP switch, this will prompt for additional tape when the size of backup grows in future and exceeds the size of a single tape).

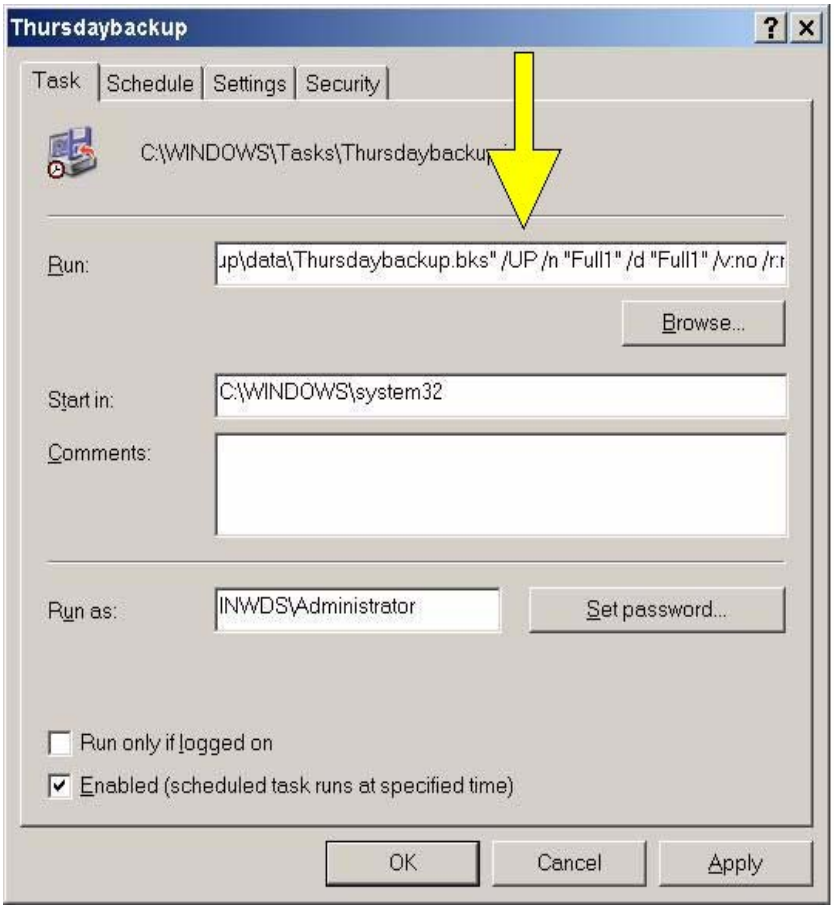
The following dialog box appears (the values within quotes on the command line in the run text box will be different between all systems).



2. In the *Run* text box, locate the /n switch right after the path for the *.bks file.



3. After the .bks" and before the /n place the /UP (case-sensitive) switch:



4. Click *Apply*. Enter the Administrator password when prompted for it and close out of the dialog box.

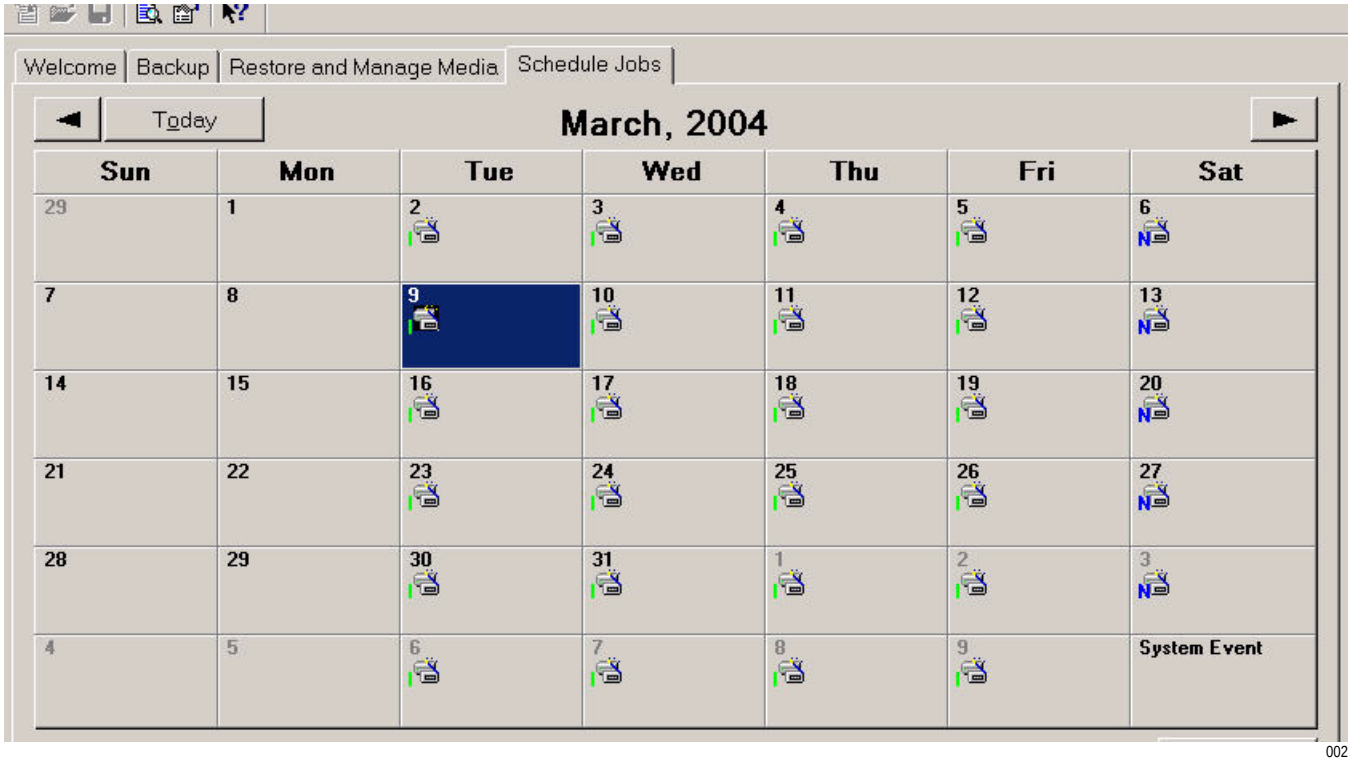
5. Repeat these steps to set the /UP switch for each full backup task (including the On Demand Backup).

9. Verify Backup Schedule

NOTE

The Schedule Jobs tab may not always refresh automatically. If the jobs are not displayed correctly, close the Backup Utility and then reopen it.

Click the *Schedule Jobs* tab. The schedule should look like this:



The schedule can be verified or modified in the following ways:

- The blue “N” indicates a Normal (i.e., Full) backup. The green “I” indicates an Incremental backup.
- Roll the cursor over each backup event. The name of the backup schedule is displayed. Ensure each incremental backup takes place on the appropriate day and Full Backup 1 and Full Backup 2 occur on alternate Saturdays.
- Click on one instance of each event to view the details. Go to the Schedule tab to ensure the schedule is correct.
- At the schedule tab, the schedule may be adjusted, if necessary.

  An incorrect schedule name (typo, etc.) can not be changed. The backup must be deleted and recreated.

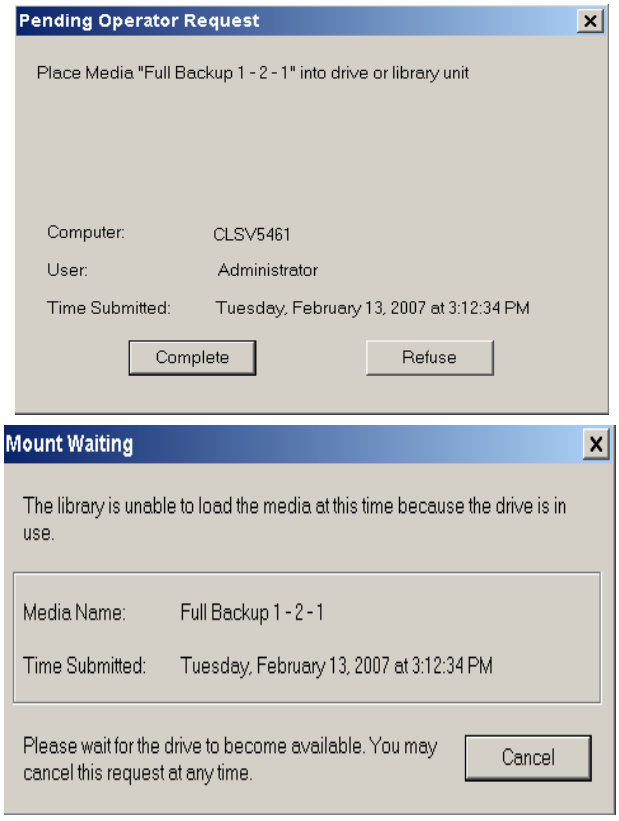
Free Additional Tape

Skip this section while configuring the jobs for the first time. For full backups that use multiple tapes the end user who will be responsible for the tape backups should perform these steps to prepare the additional tapes. The additional tapes of full tape backup that span multiple tapes have to be prepared ahead of time.

For the first time use additional tapes are prepared ahead of time in section Multiple Tape Preparation but after the first time use, the additional tapes have to be prepared manually before using them. Not preparing the additional tapes will cause full tape backup that uses multiple tapes to fail.

NOTE

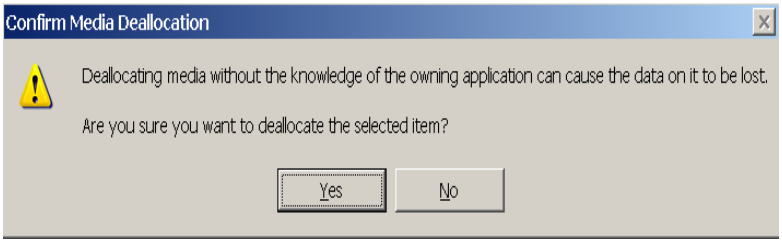
For full tape backup when the first tape is full, dialog boxes similar to the one below will appear. Do not respond to the dialog boxes insert the additional tape being requested that was prepared ahead of time. After the additional tape requested is inserted into the tape drive the backup will continue automatically.

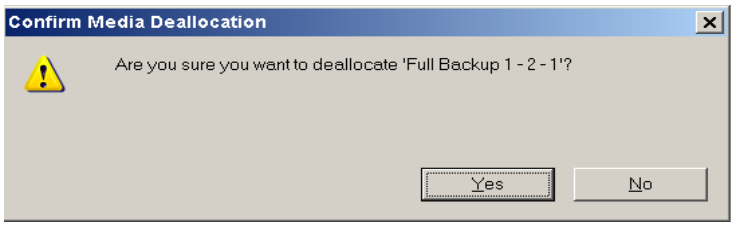

Pending Operator Request
Place Media "Full Backup 1 - 2 - 1" into drive or library unit
Computer: CLSV5461
User: Administrator
Time Submitted: Tuesday, February 13, 2007 at 3:12:34 PM
Complete
Refuse
Mount Waiting
The library is unable to load the media at this time because the drive is in use.
Media Name: Full Backup 1 - 2 - 1
Time Submitted: Tuesday, February 13, 2007 at 3:12:34 PM
Please wait for the drive to become available. You may cancel this request at any time.
Cancel

To prepare additional tapes (2nd or 3rd tape) for full backup ahead of time:

1. Insert the additional tape (2nd, 3rd ..) for full backup
2. Right click *My Computer*, choose *Manage*
3. Drop-down the *Storage* category on the left

4. Drop-down the *Removable Storage* under *Storage*
5. Click on *Media*
6. Locate the tape that was just inserted on the right hand side (In *Library* column it will list the make and the tape size for the tape that was just inserted and for all other tapes it will say *Off-line Media*)
7. Right click the tape and under all tasks choose *Deallocate*
8. Confirm to media de-allocation by choosing *Yes* to the messages listed below (the name of the tape may differ in the messages)


Confirm Media Deallocation
Deallocating media without the knowledge of the owning application can cause the data on it to be lost.
Are you sure you want to deallocate the selected item?
Yes
No



9. Verify that the tape just de-allocated is listed under *Free \ 8mm AIT 1 Media* pool
10. Eject the tape
11. Repeat the above steps for each additional tape.

NOTE

Nothing has to be changed for the first tape that will be used for a full backup and for the tapes that will be used in incremental backups.

Verify Backups Ran Successfully

After each backup tape runs for the first time, check the following the next day to ensure the backup ran successfully:

1. View the tape backup log file. To view the log file:

a. Launch backup from *Start>Programs>Accessories>System Tools>Backup*.

b. In the backup utility drop down Tools menu click on *Reports*. This will list the reports for each backup job.

c. Review the log file for the tape backup job to verify that the backup was performed successfully.

2. For Full Backups: Restore several files from the tape to an alternate location (such as *D:\Temp*). Only restore the Backup folder and the 20 most recent patient folders.

   NOTE

   Do not restore the whole backup as the server hard drive may run out of space. Make sure you delete the files after verification.

3. Verify the following files are in the backup directory: *D:\GEMMS\Prucka\Database\Maintenance\Backup*.

   - *clabbackup.bak*

     NOTE

     Check the timestamp and the size of the *clabbackup.bak* file after every backup to ensure the database was backed up successfully.

   - *clinkbackup.bak* (if the LMT database is installed)
   - *Gems.reg*

Perform On Demand Backup

CAUTION

SYSTEM PERFORMANCE DEGRADATION — A full backup takes several hours (depending on the amount of data to backup. Running a full backup while procedures are being performed may cause the system to slow unacceptably.

Always perform a full backup at a time when no procedures will be performed for several hours.

1. For single tape On Demand Backup insert the On Demand Backup tape and for multiple tape On Demand Backup insert the first tape.
2. Open the Control Panel by browsing to *Start>Settings> Control Panel*.

3. In the Control Panel double-click *Scheduled Tasks*.
4. To start the backup job:
   a. Right-click the *On Demand Backup* task.
   b. Select *Properties*.
   c. Select the *Schedule* tab.
   d. Assign a schedule to start the job in 3 to 5 minutes.
   e. When prompted for the **Administrator** password, enter the password.
   f. Select *Apply*.
   g. Click *OK* to close the dialog.
5. For multiple tape On Demand Backup: When prompted for the additional tape, insert the additional tape.
6. For multiple tape On Demand Backup: When the multiple tape backup finishes the backup tape must be verified. To verify the backup, insert the tapes as prompted.
7. For single and multiple tape On Demand Backup: Check the On Demand Backup job log to verify that it completed successfully. To view the log file:
   a. Launch backup from *Start>Programs>Accessories>System Tools>Backup*.
   b. In the backup utility drop down Tools menu click on *Reports*. This will list the reports for each backup job.
   c. Open the log file for the On Demand Backup job.

Restore from Tape Backup

This procedure explains how to restore data from a backup tape only. If server recovery is required, refer to the Field Service manual for detailed instructions.

Introduction

The overall procedure for restoring from the backup tapes is:

1. Restore the last full backup first.

2. Then restore the oldest incremental backup made after the full backup.
3. Finally, restore each succeeding incremental backup up to the previous night.
4. Verify the restore is successful. If it is not, restore the full backup from the previous week.

Procedure

1. Insert the tape.
2. Open the *Backup Utility* from the *Start* menu or desktop icon.
3. Click the *Next* button to start the restore process.
4. Select *Restore files and settings* and click *Next*.
5. Select the folders to restore:

   Full Backup:

   - *D:\GEMMS\Prucka\Database\Maintenance\Backup*
   - *D:\GEMMS\Prucka\Database\Maintenance\Log*
   - *D:\GEMMS\Prucka\Studies*

   and click *Next*.
6. Click *Advanced*.
7. Select *Original location* and click *Next*.
8. Select *Replace existing files* and click *Next*.
9. Ensure the following are selected:

   - *Restore security settings*
   - *Restore junction points, but not the folders and file data they reference*
   - *Preserve existing volume mount points*

   Select *Next* > *Finish*. The restore begins and the *Restore Progress* screen is displayed.

   If the backup spans multiple tapes, insert each tape as requested.

NOTE

Ignore the *Mount Waiting* message--just insert the next tape. The window closes automatically.

10. Click close when the restore is complete.

Enterprise Backup

Enterprise Backup Agents

All procedures regarding enterprise backup are the responsibility of the facility Enterprise Backup Manager. Ensure the following folders are backed up:

- *D:\GEMMS\Prucka\Database\Maintenance\Backup*
- *D:\GEMMS\Prucka\Database\Maintenance\Log*
- *D:\GEMMS\Prucka\Studies*

The following enterprise backup utilities have been validated for use with the ML-CL 6.5 system:

- Veritas (Version 10.0). Veritas requires an agent on the server. Use the following procedure to install:
  1. Double-click the *Setup.exe* file in the *RANT32* folder on the Veritas installation CD (the location of the folder may vary). The various install/uninstall options are listed. The one to use is: */rant32 -s*
  2. Open a command prompt window and enter the path to the RANT32 folder on the CD.

     Type in: Setup.exe /rant32 -s. The installation takes a short time, but there is no prompt when it's complete.
  3. Verify the agent is listed in *Add/Remove Programs.*
- ARCserv (Version 9.0). ARCserv does not require a client on the server
- Tivoli Storage Manager (Version 5.2.2). Tivoli does not require a client on the server.

Archiving

Introduction

Mac-Lab/CardioLab studies contain two types of information:

- Database Information: Data located in the clab database (e.g., Case Log).
- Patient Folders: Binary files located in a study directory (e.g., report documents, waveform files, image files, etc.).

The archive utility has three main functions:

- Archive: Creates a *study.bak* file (database backup for the study) and moves it, along with the study binary files, to the archive directory (usually on another server within the facility).
- Restore: Archived studies can not be viewed unless restored.
- Purge: Deletes the waveform and image files from a study. Used to save server space when studies are not archived.

NOTE

Click the *View Logs* button to see the log associated with each utility. Only files successfully archived, restored, or purged are listed. Any failures are listed to the Operating System Application Log (to view the OS Logs, right-click on *My Computer* and go to *Manage* > *Event Viewer*.

Archive Procedures

Configure Archive Service

The Archive Service must be configured before any of the procedures in this section can be performed. Archive Service configuration is performed at installation. Refer to the Configure Archive Generator procedure in the Mac-Lab/CardioLab/Centricity Cardiology INW Installation manual for additional information.

Archive Studies

NOTE

If the destination folder for the archiving the studies is on the hospital domain, read, write, and delete permissions for INW **mlclsqluser** must be granted to that folder by the Hospital administrator.

1. Open the *Archive Utility* on desktop or from the *Start* menu. The *GEMS Utilities* window is displayed.
2. Select the *Archive* icon. The *Archive Schedule* window is displayed.
3. Verify the *Archive Path* is correct. If it is not, click the *Browse* button to select a new path.
4. Set the *Archive studies older than* fields to designate the age of the study for archiving.
5. Enter the *Required free disk space*. This is the amount of free space required at the destination site and is checked before each study is archived. If this amount of space is not available, the archive for that study will fail and the error will be logged in the server Operating System Application Log.

   NOTE

   This requirement may be disabled when performing immediate archives by checking the *Ignore this setting for "Archive Now" operation*.

6. Manual Archive: Click the *Archive now* button and follow the prompts.

   Schedule the Archive: Click the *Archive now* button. The *Archive Schedule* window is displayed.

7. Ensure *Enable Schedule* is selected. And then enter the scheduling information.
8. Click *OK* to save the schedule
9. Click *Close*. The archived studies are now listed in the Mac-Lab/ CardioLab Navigator with an @ in the *Study Location* column. The number after the @ is the archive folder name (the date and time of the archive).

NOTE

Open studies are not archived. Click the *View Logs* button to see the log associated with the Archive utility. Only files successfully archived are listed. Any failures are listed in the Operating System Application Log.

Restore Archived Files

Archived studies are not accessible from the *Mac-Lab/CardioLab Navigator* window and must be restored to be viewed.

The restore utility moves a study back into the database and its associated binary files back into the study directory.

NOTE

If the folder containing the archived studies is on the hospital domain, read, write, and delete permissions for INW **mlclsqluser** must be granted to that folder by the Hospital administrator.

1. Open the *Archive Utility* on desktop or *Start* menu. The *GEMS Utilities* window is displayed.
2. Click on the *Restore* icon. The *Restore* window is displayed.
3. Verify the *Restore* path is correct. Click on the *Path* button to set a new path, if necessary.

   NOTE

   Click the *Regenerate List* button to:

   - Recreate the patient catalog found on the specified path.
   - Recreate the patient catalog when the patient folders have been moved, or the patient catalog was lost due to equipment failure.
4. Click the *Restore* button.

   NOTE

   Click the *View Logs* button to see the log associated with the Restore utility. Only files successfully restored are listed. Any failures are listed in the Operating System Application Log.

Purge

The purge function can delete the waveform and image files from a study. Purged studies are still accessible and contain the log, reports, and measurement results.

Before purging studies, note the following:

- When the server reaches 75% of storage capacity studies should either be archived or purged.
- Purging must be done during off hours (i.e., when cases are not being run).
- Purging can not be done when other processes are running (e.g., backups or archiving).
- Depending on case load and server size, purging is normally run once a quarter (every 3 months).
- Purged studies do not have any special designation in the Mac-Lab/ CardioLab Navigator.

NOTE

After a scheduled purge has run, always check the logs listed in the procedure below to verify the purge was successful. If another process runs while the purge is in progress, the purge will stop.

1. Open the *Archive Utility* on desktop or *Start* menu. The *GEMS Utilities* window is displayed.
2. Select the *Purge* icon.
3. The *Purge* window is displayed
4. Under *Files to Purge* select the files to purge (waveforms or snapshot and image files or both).
5. Set the *Purge studies older than* field. When the purge job begins, it will use this setting to determine which studies to purge.

   NOTE

   To purge the selected studies immediately, click *Purge Now*.

6. Select *Update Schedule*. The *Purge Schedule* window is displayed.
7. Select *Enable Schedule* set the purge schedule to run.
8. Enter the purge schedule and click *OK*.

   NOTE

   Click the *View Logs* button to see the log associated with the Purge utility. Only files successfully purged are listed. Any failures are listed in the Operating System Application Log.

3 Maintenance

Clean the Tape Drive

The tape drive should be cleaned when the Clean Drive light comes on.

To clean the tape drive:

1. Insert the cleaning cartridge. The tape drive will automatically load and begin to clean the drive and will automatically eject when done.
2. Place a check mark on the tape case label to show it's been used once.

Replication

CAUTION
LOSS OF DATA — Changing acquisition system replication status while procedures are being performed may result in loss of data.

Change replication status only during off hours.

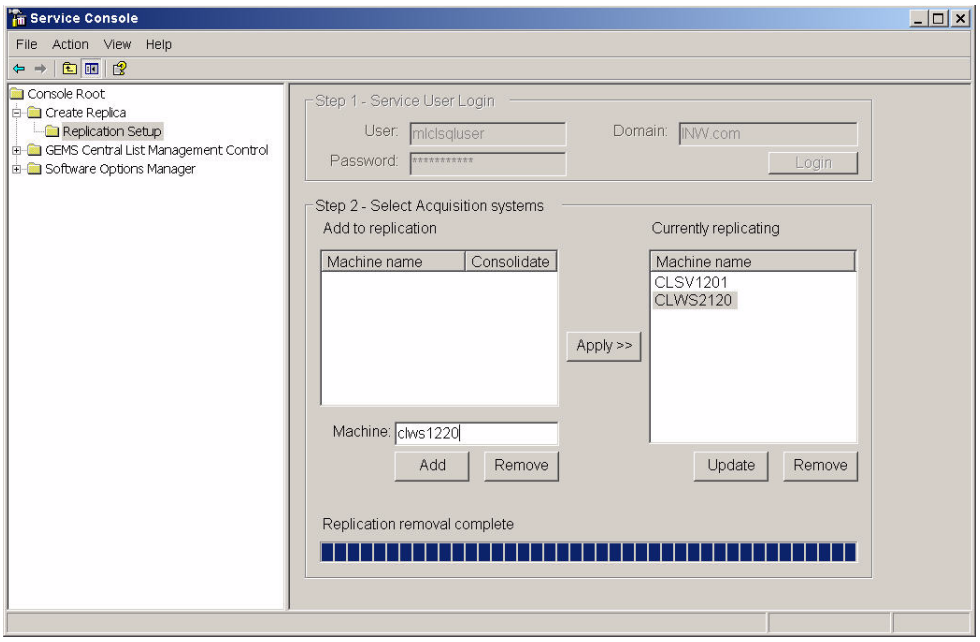
Logon

Adding or removing a system from replication requires administrative privileges.

Contact the facility IT department for the current logon if necessary.

Add a System

1. At the server, open the *Service Console* and go to *Replication Setup*. The *Service Console* screen is displayed.
2. Log on to the service console.
3. Select a system to add in one of the following ways:
   - Click *Add* and use the browse window to select the acquisition system.
   - Type in the acquisition system name in the *Machine* field and click *Add*.



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4. Select the system in the left column and click the *Apply* button.
5. Click *Yes* to the confirmation message.

   Replication takes several minutes to complete.
6. Refresh the window (click on another folder in the tree and then click on *Replication Setup* again) to verify the Acquisition system has been added to replication.

Remove a System

Systems are normally taken out of replication only if the equipment fails, is upgraded, or is to be moved.

1. At the server, open the *Service Console* and go to *Replication Setup*. The *Service Console* screen is displayed.
2. Log on to the service console.
3. Highlight the system to remove in the list of currently replicating systems.
4. Click the *Remove* button. Stop replication should only take a few seconds to complete.

5. Refresh the window (click on another folder in the tree and then click on *Replication Setup* again) to verify the Acquisition system has been removed from replication.

Microsoft Security Patches

Information concerning Microsoft security patches for the server are available through the GE Healthcare Product Security Website, with the patches themselves available through the Microsoft security site:

- GE: http://apps.gemedicalsystems.com/product_security/protection/modality_links.html
- Microsoft: http://www.microsoft.com/technet/security/default.mspx

Customers are responsible to stay informed with vulnerability notification from Microsoft and to visit the GE Healthcare Product Security website to understand the impact on Mac-Lab, CardioLab, ComboLab, and INW.

Customers are responsible for the installation of any needed Microsoft software patch. The listing and link of the Microsoft software patch will be available by the product name on the website.

4 Troubleshooting

Overview

This section lists some common troubleshooting scenarios. Overall, recheck the job configuration to ensure:

- The scheduled time is correct.
- The appropriate job, files, or folders have been selected.
- The destination path is correct and available (e.g., there is a tape in the drive, the folder share is setup correctly, etc.).

Replication

Refer to the Mac-Lab/CardioLab 6.5 Service manual, Troubleshooting section for network troubleshooting.

Database Maintenance

The clab DB or Registry files are not in the *D:\GEMMS\PRUCKA\Database\Maintenance\backup* folder.

Ensure the job schedule is correct. Check the following jobs

- *Backup clab, clink databases and GEMS registry*. This job is scheduled to run nightly.
- *Database Maintenance*. This job is scheduled to run weekly.
- *Backup Master and MSDB databases*. This job is scheduled to run monthly.

Backup

1. A folder that was supposed to be backed up is missing from the backup tape.

   Ensure all required folders have been selected for the backup job (refer to the Backup procedure for a list of the folders).

2. The backup failed.

   - Ensure the tape is not full or defective.
   - Ensure the correct backup tape was used and it was labeled correctly.

3. The backup failed to occur, but no errors were generated.

   Recheck the following:

   - The appropriate folders were selected.
   - The job was scheduled properly.

Archive/Restore

1. The archive fails, but I can't find the failure listed in the archive log.

   The archive log only lists files successfully archived. Failures are recorded in the Operating System Application Log (Right-Click on *My Computer* and go to *Manage* > *Event Viewer* to see the logs).

2. The entire archive fails.

   Verify the following:

   - The path to the remote server is correct.
   - Access to the share is allowed.
   - The archive service has been properly configured under the proper account (refer to the INW Server Installation Manual for Archive Service Configuration procedures).

3. One study failed to archive.

   Ensure the study was closed. Open studies cannot be archived.

4. The patient I want to restore is missing.

   Click the *Regenerate List* button. If the study is still not shown, check the following:

   - The path to the remote server is correct.
   - Studies haven't been moved from the remote location.

A Abbreviations

Electrical & IT Abbreviations

Abbreviation	Description
AD	Active Directory
AC	Alternating Current
AE	Application Entity
AIT	Advanced Intelligent Tape
Com	Communication
CMC	Crystal Management Console
CNDT	Conduit
CPU	Central Processing Unit
DAT	Digital Audio Tape
DC	Direct Current
DICOM	Digital Imaging and Communication in Medicine
DMS	Data Management System
DOS	Disk Operating System
D-Sub	hardware connector
dV/dT	change in Voltage over Time
EMC	Electromagnetic Compatibility
EMI	ElectroMagnetic Interference
ESD	Electrostatic Discharge
GB	gigabytes
HW/SW	Hardware/Software
Hz	Hertz
IEB	Integrated Electronics Box
IEC	International Electrotechnical Commission
INW	Invasive Net Work formerly known as CardioLink

Abbreviation	Description
IT	Information Technology
KB	Kilobytes
kOhm	kilo-ohms
KV	Kilovolts
LCD	Liquid Crystal Display
LMT	Lab Management Tools
MB	Megabytes
MHz	Mega Hertz
ML/CL	Mac-Lab/CardioLab
MWL	Modality Work List
MPPS	Modality Performed Procedure Step
ms	milliseconds
MSDE	MicroSoft Data Engine
mV	millivolts
OD	Optical Disk
OS	Operating System
OU	Organizational Unit
PC	Personal Computer
pcb	Printed Circuit Board
PDF	Portable Document Format
RAC-4A	Remote Acquisition Case
RAU	Remote Acquisition Unit
RF	Radio frequency
TCP/IP	Internet Protocol
UI	User Interface
UPS	Uninterruptible Power Supply

Abbreviation	Description
VIDMUX	Video Multiplexer
V	Volts
VPN	Virtual Private Network

Hospital Staff

Abbreviation	Description
RN	registered nurse
LPN	licensed practical nurse
LVN	licensed vocational nurse
RT	radiology technologist
RRT	registered respiratory therapist
CVT	cardiovascular technologist
RCIS	registered cardiac interventional specialist
RTRCV	radiologic technologist registered cardiovascular
RCPT	registered cardiopulmonary technologist
MD	doctor of medicine
DO	doctor of osteopathic medicine
PA	physician's assistant
RTR	radiologic technologist registered cardiovascular
NP	nurse practitioner
PhD	doctor of philosophy
RCVT	registered cardiovascular technologist
NA	nurse's assistant
MD/PhD	Physician/Doctor
RCS	registered cardiac sonographer

Abbreviation	Description
CNS	cardiac nurse specialist
DR	doctor
CVVT	certified cardiovascular technologist
CRNA	certified registered nurse anesthetist

Medical Abbreviations

Abbreviation	Description
0COf	Cardiac Output by Fick
ABAO	Abdominal Aorta
ACC	American College of Cardiology
ACV	Antecubital Vein
ADT	Admission Discharge Transfer
AIR	Room Oxygen Temperature
Ao	Aorta or Aortic Pressure
APV	Anamalous Pulmonary Vein
ARCH	Transverse Aortic Arch
AREA	Area - No Valve
ARP	Antegrade Refractory Period
ART	Arterial
ARTSAT	Arterial Saturation
ASAO	Ascending Aorta
ATM	Atmospheres
ATPS	Ambient Temperature and Pressure where Gas is Saturated with Water Vapor
AVA	Aortic Valve Area

Abbreviation	Description
Vaudeville	Arteriovenous Oxygen Difference
aVF	left foot augmented lead
AVF	Aortic Valve Flow
AVG	Aortic Valve Gradient
AVI	Aortic Index or Aortic Valve Area Index
aVL	left arm augmented lead
AVN ERP	Atrio-Ventricular Node Effective Refractory Period
A-VO2 diff	Arterial - Venous Oxygen difference
aVR	right arm augmented lead
AXA	Axiliary Artery
AXV	Axiliary Vein
AZV	Azygos Vein
BA	Brachial Artery
BIM	bioelectric impedance measurement
BP	Blood Pressure
BPM	Beats Per Minute
BSA	Body Surface Area
BV	Brachial Vein
C.I.	Cardiac Index
C.O.	Cardiac Output
CA	Common Atrium
CARA	Carotid Artery
cath	catheterization
CCU	Coronary Care Unit
CI	Cardiac Index
CIM	Catheter Input Modules

Abbreviation	Description
Clin Proc	Clinical Procedures
CO	Cardiac Output
COL	Systemic Collateral Artery to Lungs
Comp	Complications
Cond Intvls	Conduction Intervals
Cons Sed	Conscious Sedation
COR	Coronary Artery
COtd	Cardiac Output obtained by Thermodilution
COUT	Cardiac Output
COUTI	Cardiac Index
CPT	Current Procedural Terminology
CS	Coronary Sinus
CSNRT	Corrected Sinus Node Recovery Time
CV	Common Ventricle
CVIS	Cardiovascular Information System
CVP	Central Venous Pressure
DCS	Distal Coronary Sinus
DFP	Diastolic Filling Period
DFPm	Mitral Diastolic Filling Period
DFPt	Tricuspid Diastolic Filling Period
DFT	Diastolic Filling Time
Dias	Diastolic
dp/dt	change in pressure per unit in time
DSAO	Descending Aorta
ECG	ElectroCardioGram
EDP	End Diastolic Point

Abbreviation	Description
Emerg	Emergency
EP	electrophysiology
ER	Emergency Room
ERP	Effective Refractory Period
ESU	Electrosurgical Unit
ETCO2	End Tidal CO_2
EXP CO2	Expired CO_2
FA	Femoral Artery
FCa	Arterial Content
FCI	Fick Cardiac Index
FCLA	Fistula Coronary to the Left Atrium
FCLV	Fistula Coronary to the Left Ventricle
FCpa	Pulmonary Artery Content
FCpv	Pulmonary Venous Content
FCRA	Fistula Coronary to the Right Atrium
FCRV	Fistula Coronary to the Right Ventricle
FCv	Venous Content
FEO2	Oxygen of Expired Air
FIO2	Oxygen of Inspired Air
FIS	Arterial Fistula
FLOW	Flow - No Gradient
FRZ	Freeze
FV	Femoral Vein
Gcm2	Gray-centimeter squared
HABAO	High Abdominal Aorta
HAO	High Aorta

Abbreviation	Description
HARCH	High Transverse Aortic Aorch
HASAO	High Ascending Aorta
HAZ	Hemiazygos Vein
Hb	Hemaglobin
HDSAO	High Descending Aorta
HEPA	Hepatic Artery
HEPV	Hepatic Vein
HIPAA	Health Insurance Portability and Accountability Act
HIS	Hospital Information System
HIVC	High Inferior Vena Cava
HLA	Hight Left Atrium
HLV	Hight Left Ventricle
HLVA	High Left Ventricular Apex
HLVIN	High Left Ventricle Inflow
HLVOC	High Left Ventricle Outflow
HNAO	High Neo-Aorta
HR	Heart Rate
HRA	High Right Atrium
HRAO	Heart Rate
HRf	Fick Heart Rate
HRU	Hybrid Resistance Units
HRV	Hight Right Ventricle
HRVA	High Right Ventricular Apex
HRVIN	High Right Ventricular Inflow
HRVIN	High Right Ventricle Inflow
HRVOT	Hight Right Ventricular Outflow

Abbreviation	Description
HSVC	High Superior Vena Cava
HUA	High Umbilical Artery
HUV	High Umbilical Vein
HVC	High Vena Cava
I/O	Intake/output
IABP	Intra-Aortic Balloon Pump
IB	Inferior Baffle
IC	Intra-cardiacs
ICU	Intensive Care Unit
IM	Internal Mammary
IMA	Internal Mammary Artery
INDEX	Valve Index or Area Index - No Valve
INNA	Innominate Artery
INNV	Innominate Vein
INSP CO2	Inspired CO_2
IVC	Inferior Vena Cava
JX	Juxtaposed Appendage
LA	Left Atrium
LACV	Left Antecubital Vein
LaM	Mean Left Atrial Pressure
LAO	Low Aorta
LAPV	Left Anamolous Pulmonary Vein
LARCH	Low Transverse Aortic Arch
LART	Left Arterial
LASAO	Low Ascending Aorta
LAXA	Left Auxiliary Artery

Abbreviation	Description
LAXV	Left Auxiliary Vein
LAZV	Left Azygos Vein
LBA	Left Brachial Artery
LBAO	Low Abdominal Aorta
LBV	Left Brachial Vein
LCA	Left Common Atrium or Left Coronary Artery
LCARA	Left Carotid Artery
LCNDT	Left Conduit
LCOR	Left Coronary Artery
LCV	Left Common Ventricle
LDSAO	Low Descending Aorta
LED	Light Emitting Diode
LFCLV	Left Fistula Coronary to Left Ventricle
LFCRA	Left Fistula Coronary to Right Atrium
LFCRV	Left Fistula Coronary to Right Ventricle
LFIS	Left Arterial Fistula
LFV	Left Femoral Vein
LHAZ	Left Hemiazygos Vein
LHEPA	Left Hepatic Artery
LHEPV	Left Hepatic Vein
LIB	Left Inferior Baffle
LIMA	Left Internal Mammary Artery
LINNA	Left Innominate Artery
LINNV	Left Innominate Vein
LIVC	Low Inferior Vena Cava
LJX	Left Juxtaposed Appendage

Abbreviation	Description
LLA	Low Left Atrium
LLV	Low Left Ventricle
LLVA	Low Left Ventricular Apex
LLVIN	Low Left Ventricle Inflow
LLVOT	Low Left Ventricle Outflow
LNAO	Left Neo-Aorta
LNPA	Left Neo Pulmonary Artery
LOC	Level of Consciousness
LPA	Left Pulmonary Artery
LPAB	Left Pulmonary Artery Branch
LPACN	Left Pulmonary Artery Conduit
LPAVF	Left Pulmonary Artery Venous Fistula
LPAW	Left Pulmonary Artery Wedge
LPDA	Left Patent Ductus Arteriosus
LPV	Left Pulmonary Vein
LPVAT	Left Pulmonary Venous Atrium
LPVC	Left Pulmonary Vein chamber in Cor Triatriatum
LPVCN	Left Pulmonary Vein Confluence
LPVW	Left Pulmonary Vein Wedge
LRA	Low Right Atrium
LRADA	Left Radial Artery
LRENV	Left Renal Vein
LRFLOW	Left to Right Flow
LRFLOWI	Left To Right Shunt Flow Index
LRV	Low Right Ventricle
LRVA	Low Right Ventricular Apex

Abbreviation	Description
LRVIN	Low Right Ventricular Inflow
LRVOT	Low Right Ventricular Outflow
LSBCA	Left Subclavian Artery
LSCLV	Left Subclavian Vein
LSHNT	Left Systemic Pulmonary Shunt
LSP	Left Special
LSPHV	Left Saphenous Vein
LSVC	Low Superior Vena Cava
LTAC	Left Truncus Arteriosus Communis
LUA	Low Umbilical Artery
LUV	Low Umbilical Vein
LV	Left Ventricle
LVA	Left Ventricle Apex
LVC	Low Vena Cava
LVEDP	Left Ventricular End Diastolic Period
LVEN	Left Venous
LVET	Left Ventricle Ejection Time
LVFT	Left Ventricle Filling Time
LVIN	Left Ventricle Inflow
LVOC	Left Ventricle Outflow Chamber
LVOT	Left Ventricle Outflow
LVRTA	Left Vertebral Artery
LVSW	Left Ventricular Stroke Work
LVSWI	Left Ventricle Stroke Work Index
MAP	Mean Arterial Pressure
Meds	Medications

Abbreviation	Description
MMF	Mean Maximum Flow
MRN	Medical Record Number
MV	Mixed Venous
MVA	Mitral Valve Area
MVF	Mitral Valve Flow
MVG	Mitral Valve Gradient
MVGpcws	Mitral Valve Splice Pulmonary Capillary Wedge
MVI	Mitral Index or Mitral Valve Area Index
NAO	Neo Aortic Arch
NIBP	Non-Invasive Blood Pressure
NICU	Neuro Intensive Care Unit
NPA	Neo Pulmonary Artery
O2	Oxygen
Op	Operative
PA	Pulmonary Artery
PAB	Pulmonary Artery Branch
PACN	Pulmonary Artery Conduit
PAFV	Pulmonary Arteovenous Fistula
PAm	Mean Pulmonary Arterial Pressure
PAO2	Mixed Venous Oxygen Saturation a/k/a Pulmonary Artery Saturation
PAW	Pulmonary Artery Wedge
Pb	Barometric Pressure
PCI	Percutaneous Coronary Intervention
PCS	Proximal Coronary Sinus
PCW	Pulmonary Capillary Wedge Pressure
PDA	Patent Ductus Arteriosus

Abbreviation	Description
PER	Period - No Value
PID	Patient Identification
PO2	Dissolved Oxygen Tension a/k/a Partial Pressure of Oxygen
PV	Pulmonary Vein
PVA	Pulmonary Valve Area
PVAT	Pulmonary Venous Atrium
PVCH	Pulmonary Vein Chamber in Cor Triatriatum
PVCN	Pulmonary Vein Confluence
PVF	Pulmonary Valve Flow
PVG	Pulmonary Valve Gradient
PVGs	Pulmonary Valve Splice
PVI	Pulmonary Index or Pulmonary Valve Area Index
PVO2	Pulmonary Vein Saturation
PVR	Peripheral Vascular Resistance
PVR_SVR ratio	Pulmonary Vascular Resistance, Systemic Vascular Ratio
PVR_W	Pulmonary Vascular Resistance in Wood Units
PVRI	Pulmonary Vascular Resistance Index
PVRI_W	Pulmonary Vascular Resistance in Wood Units
PVW	Pulmonary Vein Wedge
Qeff	Effective Pulmonary Flow
Qp	Pulmonary Flow
Qp/Qs	Flow Ratio
QPEFFI	Effective Pulmonary Flow Index
Qpl	Pulmonary Flow Index
Qs	Systemic Flow

Abbreviation	Description
Qsl	Systemic Flow Index
R	Report
RA	Right Atrium
RACV	Right Antecubital Vein
Rad	Radiology
RADA	Radial Artery
RaM	Mean Right Atrial Pressure
RAPV	Right Anamolous Pulmonary Vein
RART	Right Arterial
RAVZ	Right Azygos Vein
RAXA	Right Auxiliary Artery
RAXV	Right Auxiliary Vein
RBA	Right Brachial Artery
RCA	Right Common Atrium or Right Coronary Artery
RCARA	Right Carotid Artery
RCNDT	Right Conduit
RCOR	Right Coronary Artery
RCV	Right Common Ventricle
RENA	Renal Artery
RENV	Renal Vein
RFA	Right Femoral Artery
RFCLA	Right Fistula Coronary to Left Atrium
RFCLV	Right Fistula Coronary to Left Ventricle
RFCRA	Right Fistula Coronary to Right Atrium
RFV	Right Femoral Vein
RHAZ	Right Hemiazygos Vein

Abbreviation	Description
RHEPA	Right Hepatic Artery
RHEPV	Right Hepatic Vein
RIB	Right Inferior Baffle
RIMA	Right Internal Mammary Artery
RINNA	Right Innominate Artery
RINNV	Right Innominate Vein
RJX	Right Juxtaposed Appendage
RLFLOW	Right to Left Flow
RLFLOWI	Right to Left Shunt Flow Index
RMOT	Remote Operators Terminal
RNPA	Right Neo Pulmonary Artery
ROI	Region of Interest
RPA	Right Pulmonary Artery
RPAB	Right Pulmonary Artery Branch
RPACN	Right Pulmonary Artery Conduit
RPAVF	Right Pulmonary Artery Venous Fistula
RPAW	Right Pulmonary Artery Wedge
RPDA	Right Patent Ductus Arteriosus
RPV	Right Pulmonary Vein
RPVAT	Right Pulmonary Venous Atrium
RPVC	Right Pulmonary Vein chamber in Cor Triatriatum
RPVCN	Right Pulmonary Vein Confluence
RPVW	Right Pulmonary Vein Wedge
RR	Respiratory Rate
RRADA	Right Radial Artery
RRENV	Right Renal Vein

Abbreviation	Description
RRP	Retrograde Refractory Period
RSCLV	Right Subclavian Vein
RSHNT	Right Systemic Pulmonary Shunt
RSP	Right Special
RSPHV	Right Saphenous Vein
RT	Room Temperature
RTAC	Right Truncus Arteriosus Communis
RVA	Right Ventricle Apex
RVEN	Right Venous
RVET	Right Ventricle Ejection Time
RVFT	Right Ventricle Filling Time
RVIN	Right Ventricle Inflow
RVOT	Right Ventricle Outflow
RVSW	Right Ventricular Stroke Work
RVSWI	Right Ventricle Stroke Work Index
RVTRA	Right Vertebral Artery
SA	Systemic Artery
SAm	Mean Systemic Arterial Pressure
Sat	Saturation
SB	Superior Baffle
SBCA	Subclavian Artery
SCL	Sinus Cycle Length
SCLV	Subclavian Vein
SCV	Superior Vena Cava
SEP	Systolic Ejection Period
Sep/Dfp	Systolic Ejection Period divided by Diastolic Filling Period

Abbreviation	Description
SEPa	Aortic Systolic Ejection Period
SEPp	Systolic Ejection Period
SHNT	Systemic Pulmonary Shunt
SNRT	Sinus Node Recovery Time
SP	Special Pressure
SPHV	Saphenous Vein
SpO2	Peripheral Oxygen Saturation
Stat	statim (Latin for immediately)
Stim	Stimulus
STPD	Standard Temperature and Pressure of Dry Gas
STS	Society of Thorasic Surgeons
SV	Stroke Volume
SVA	Systemic Venous Atrium
SVI	Stroke Index
SVR	Systemic Vascular Resistance
SVR_W	Systemic Vascular Resistance in Wood Units
SVRI	Systemic Vascular Resistance Index
SVRI_W	Systemic Vascular Index in Wood Units
sync	synchronis
Sys	Systolic
T	Room Temperature
TAC	Truncus Arteriosus Communis
TDCI	Thermodilution Cardiac Index
TDCO	Thermodilution Cardiac Output
TPR	Total Peripheral Resistance
TPR_TVR ratio	Total Pulmonary Resistance, Total Vascular Resistance Ratio

Abbreviation	Description
TPR_W	Total Pulmonary Resistance, Wood Units
TPRI	Total Pulmonary Resistance Index
TPRI_W	Total Pulmonary Index, Wood Units
TPVR_W	Total Pulmonary Vascular Resistance in Wood Units
TPVRI_W	Total Pulmonary Vascular Resistance Index in Wood Units
TRAM	Transport Remote Acquisition Monitor
Trig	Trigger
TSVR	Total System Vascular Resistance
TSVR_W	Total Systemic Vascular Resistance in Wood Units
TVA	Tricuspid Valve Area
TVF	Tricuspid Valve Area
TVG	Tricuspid Valve Gradient
TVGs	Tricuspid Valve Splice
TVI	Tricuspid Index or Tricuspid Valve Area Index
TVR	Total Vascular Resistance
TVRI	Total Vascular Resistance Index
TVRI_W	Total Vascular Resistance Index in Wood Units
UA	Umbilical Artery
UV	Umbilical Vein
VA	Valve Area
VC	Vena Cava
VeATPS	Minute volume at ATPS
VEN	Venous
VENSAT	Venous Saturation

Abbreviation	Description
VeSTPD	Minute volume
VeSTPD	Volume of Gas (Corrected)
VF	Valve Flow or Ventricular Fibrillation
VGs	Valve Splice
VI	Valve Index
VO2	Oxygen Consumption
VRTA	Vertebral Artery
WCT	Wilson Central Terminal
WU	Wood Units

Miscellaneous Abbreviations

Abbreviation	Description
3-D	Three Dimensional
Accts	Accounts
C	Centigrade
Cal	Calibration
cm	centimeters
cm2	centimeters squared
$C0_2$	Carbon Dioxide
etc.	etcetera
FAQ	Frequently Asked Questions
gm/dl	grams per deciliter
Grad	Gradient
HT	Height
HH:MM:SS	Hours:Minutes:Seconds

Abbreviation	Description
ID	Identity
IMG	Image
Info	Information
Kgs	kilograms
KT	Water Vapor Pressure
lb	pounds
l/min	liters per minute
l/min/m2	liters per minute per milliliter squared
mcg	micrograms
ml/dl	milliliters per deciliter
ml/min	milliliters/minute
ml/s	milliliters per second
mm/hg	millimeters of mercury
mm/sec	millimeters per second
UL	Underwriter's Laboratory

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